An android based remote control framework for smart home components

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Abstract

Im Rahmen dieser Arbeit wird ein „lowcost" System für smarthome-Anwendungen vorgestellt. Die Steuerung der smarthome-Komponenten erfolgt durch einen Appliance-Controller auf Basis des FS20 Protokolls, wogegen die „Intelligenz" des Systems durch eine mobile Anwendung (Android-OS) realisiertwird. Durch Auslagerung der Rechenleistung und der Benutzerschnittstelle auf das smartphone kann eine kostengünstige Alternative zur bestehenden Smarthome-Systemen aufgezeigt werden, die durch Einbindung externer Anwendungen leicht erweitert werden kann.

An android based remote control framework for smart home components

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1.6 An android based remote control framework for smart home components

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Abstrakt
Im Rahmen dieser Arbeit wird ein „low-cost“ System für smarthome-Anwendungen vorgestellt. Die Steuerung der smarthome-Komponenten erfolgt durch einen Appliance-Controller auf Basis des FS20 Protokolls, wogegen die „Intelligenz“ des Systems durch eine mobile Anwendung (Android-OS) realisiert wird. Durch Auslagerung der Rechenleistung und der Benutzerschnittstelle auf das smartphone kann eine kostengünstige Alternative zur bestehenden Smarthome-Systemen aufgezeigt werden, die durch Einbindung externer Anwendungen leicht erweitert werden kann.

The problem
The common concept for designing a smart home environment is to categorize in two main networks: the outdoor broadband communication network and the indoor control network [1]. Both networks are connected by a so called “residential gateway” [2], which have two main functionalities:

1. Bridging the indoor control network to the (outdoor) communication network
2. Providing (smart) services for controlling and managing the smart home devices (home appliances, switches, motors, etc.)

However, implementing the second powerful hardware leading to cost-expensive residential gateways. And even if the OSGi framework [3] provides some basic technologies, remote management and deployment of services still remains an unsolved issue.

The concept
Therefore, we developed an alternative approach, based on mobile computing implemented on the android framework: instead of putting all the intelligence into a residential gateway, we use the power of the mobile devices for implementing smart services. Therefore, we developed a low-cost systems for remote control of home appliances (switches, lightening, heating, etc.), based on the FS20 system. For a survey of available components see [4].

The implementation
All the components (actuators and sensors) of the FS20 system can be controlled by a low-cost control unit, called “EZcontrol XS1”. This control unit provides internet connectivity and each component can be control through HTTP-request and JSON based response.

Based on the Model-View-Controller design pattern, we developed an control framework android devices, with which we can (a) dynamically add or remove new components (b) visualize the state of each component (c) modify the state of each component (e.g switch the light on, turn temperature down, etc.). For obtaining “live” data of the current state of the system, we make use of the HTTP chunked encoding, which is provided by the control station.

The GUI is based on standard UI components provided by the Android framework, e.g. for binary switches we use “toggle buttons” and for linear switches a common scrollbar. All the components are listed sequentially and can dynamically added or removed. More sophisticated services like timers can be added for each component individually.

The big picture
Based on our open framework, we now have the possibility to remotely control a large variety of actuators (power switches dimmer switches, heating regulators, sun-blinds, etc) and sensors (power meters, temperature sensors, motion detectors, etc.).

Additionally, we can easily integrate 3rd-parties application, if they provide intent filters (open intents). For example, we can use QR-codes based on the QR-Driod application [5] for identifying certain home appliances: each home appliance obtains its own ID which is encoded in the QR-code and the QR-code is then sticked to the associated home appliance. Within our application, we can call the QRDroid application by setting up the QRDroid-intent and obtain this ID, with which we automatically pop up the associated control panel.

Moreover, we can fully exploit the power of location services provided by the android platform and combine these services with our remote control services, enabling scenarios like automatically turning down the heating, if all residents left home and turning on the heating if one of them comes close the his home.

The conclusion
We developed a low-cost framework for

Fig. 1.6-1: *User Interface of our remote control framework: survey of components*

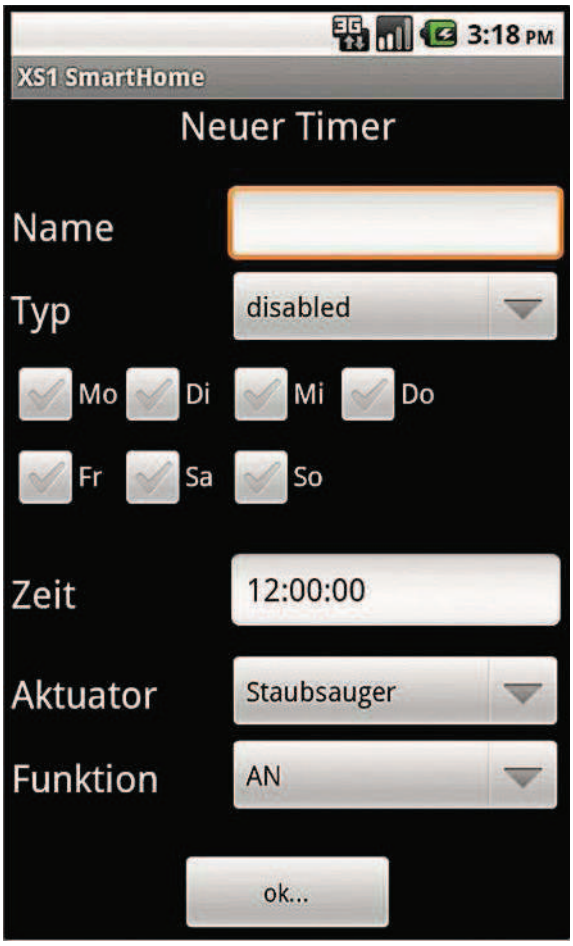

Fig. 1.6-2: *Programming timer services*

remote control of home appliances. The "intelligence" of the system is implemented in the android device, whereas the control station just serves as a bridge towards the actuators and sensors.

Our system can easily extended by integrating 3rd-party apps if they provide open intents as an interface. Moreover, complex applications exploiting user location or context can be easily implemented programmatically – however a click-and-drop like UI like Yahoo-Pipes is still part of our research.

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